(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 530 967 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **92306783.9**

(51) Int. Cl.[5]: **F16K 27/00**, F16K 13/00

(22) Date of filing: **24.07.92**

(30) Priority: **03.09.91 GB 9119196**

(43) Date of publication of application:
10.03.93 Bulletin 93/10

(84) Designated Contracting States:
BE CH DE ES FR IT LI NL

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(54) An improved flow control system.

(57) A fluid flow control system in which a vortex valve is combined in series with a non-fluidic control valve. The non-fluidic control valve is upstream of the vortex valve and is so arranged that small changes in its state control the operation of the vortex valve, which provides the major control over the flow of the fluid. Erosion in the non-fluidic valve due to abrasion or cavitation in the non-fluidic valve is thereby reduced.

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The present invention concerns fluid flow control systems.

A major problem with industrial fluid flow systems, particularly when a fluid is abrasive, such as a slurry or aerosol, or contains dissolved gases, is erosion of control valves included in the fluid flow systems, due either to the abrasive nature of the fluid itself, or to cavitation when the valves are operating in a state in which they present considerable resistance to the flow of the fluid.

It is an object of the present invention to provide a fluid flow control system in which the erosion of control valves is reduced.

According to the present invention a fluid flow control system comprises a first flow line with a vortex valve having a vortex chamber in the flow line such that fluid in the flow line enters radially into the vortex chamber and emerges axially from the vortex chamber and a further flow line for introducing a control flow into the vortex chamber, wherein the further flow line communicates with the first flow line at a junction upstream of the vortex valve and a non-fluidic valve is included in the first flow line between the junction of the first flow line and the further flow line and the vortex valve.

The non-fluidic valve can be any form of mechanical valve, such as for example a tap, butterfly or diaphragm and can be operated manually or by power means.

The invention will be described further, by way of example, with reference to the accompanying diagrammatic drawings, in which:-

Figure 1 is a diagrammatic sketch of a flow control system;

Figure 2 is an embodiment of the flow control system; and

Figure 3 illustrates a component part of a vortex valve.

The drawing shows a vortex valve 1 included in a flow line 2 for a fluid which can be gas or liquid. The vortex valve is a fluidic device having a vortex chamber 3 with inlet, outlet and control ports. In the present arrangement fluid flowing along the flow line 2 in the direction indicated by the arrow enters radially into the vortex chamber 3 at the inlet port and emerges axially from the chamber 3 at the outlet port.

A further flow line 4 is connected to the control port or ports of the vortex valve 1 and extends to a junction 5 in the first flow line 2 upstream of the vortex valve 1. A non-fluidic valve 6 is included in the flow line 2 at a position between the junction 5 and the vortex valve 1. The valve 6 can be any suitable type of mechanical valve and as example only mention can be made of butterfly and diaphragm valves. In addition the valve 6 can be operated by hand or by power means. The further flow line 4 can itself form or can include a flow restrictor to provide required divisions of flow between the lines 2 and 4.

In use and with the valve 6 fully open fluid in the line 2 can flow unhindered through both the valve 6 and the vortex valve 1. In the absence of control flow the vortex valve is in its low resistance mode.

Upon closing the valve 6, a pressure difference is created across the valve 6 with the result that the pressure at the inlet to the vortex valve 1 is less than the pressure at the upstream side of the valve 6 and hence is less than the pressure in the further flow line 4 to the control port. Thus, closing the valve 6 causes an increase in the pressure difference between the control and inlet ports. The control flow along the further flow line 4 acts on the flow along the line 2 to create a vortex in the vortex chamber 3 to thereby increase the flow resistance of the vortex valve 1. The resistance of the vortex valve 1 increases progressively with the closing of the valve 6.

The combination of the valve 6 and the vortex valve 1 functions as a control in the flow line 2. A small pressure drop across the valve 6 resulting in a small control flow can cause a significant increase in the resistance of the vortex valve 1 to flow along the line 2. The advantage from this arrangement compared to a non-fluidic valve alone in the flow line 2 is that the main resistance to flow occurs in the vortex valve 1 and does not take place at the valve 6. As mentioned a slight closing of the valve 6 can effect a considerable increase in the flow resistance of the vortex valve 1. Upon closing the valve 6 the flow velocity therethrough increases with consequent problems of erosion and cavitation effects on the valve 6. In combination with the vortex valve it is not necessary to close the valve 6 to the same extent as when using the valve 6 alone to obtain the same control in the flow. As a result the problems of erosion and cavitation are reduced with improved life for the valve 6.

Figures 2 and 3 show one embodiment of the system and where applicable the same reference numerals are used in Figure 2 to denote the corresponding components in Figure 1.

In Figure 2, the vortex valve 1 and the non-fluidic valve 6 are mounted or secured to flanges 7 at the ends of a short length of pipe 8, the pipe being a part of the flow line 2. In this embodiment the valve 6 is a butterfly valve.

The vortex valve 1 comprises a body 9 centrally supported within an annular body 10 by a spider 11. The body 10 is secured to the flange 7 at the end of the pipe 8. An annular plate 12 is mounted on the body 10 and the valve 1 is completed by a cover housing 13 secured to the plate 12. An outlet diffuser 14, being a part of the flow line 2, extends axially from the cover housing 13.

A vortex chamber 15 is formed between the body 9 and the annular body 10 and the plate 12. The body 9 comprises a cylindrical portion with a conical portion directed towards the valve 6.

A conduit 16 provides communication between apertures in the flanges 7. A passage 17 in the housing of the valve 6 extends from the conduit 16 to open into the flow line 2 immediately upstream of the butterfly valve 6, the flow direction being shown by the arrow in Figure 2. A similar passage 18 in the annular body 10 provides communication between the conduit 16 and a continuous circular groove 19 formed in the face of the annular body 10 abutting against the annular plate 12.

As shown in Figure 3, the annular plate 12 is formed with four equiangularly spaced apart channels or slots 20, each slot 20 having a nozzle 21 communicating substantially tangentially with the bore of plate 12.

The path formed by the passage 17, the conduit 16, passage 18, groove 19, slots 20 and nozzles 21 corresponds to the flow line 4 in Figure 1.

Claims

1. A fluid flow control system comprises a first flow line with a vortex valve having a vortex chamber in the flow line such that fluid in the flow line enters radially into the vortex chamber and emerges axially from the vortex chamber and a further flow line for introducing a control flow into the vortex chamber, wherein the further flow line (4) communicates with the first flow line (2) at a junction (5) upstream of the vortex valve (1) and a non-fluidic valve (6) is included in the first flow line (2) between the junction (5) of the first flow line (2) and the further flow line (4) and the vortex valve (1).

2. A fluid flow control system according to Claim 1 wherein the non-fluidic control valve (6) comprises a mechanical valve.

3. A fluid flow control system according to Claim 1 or Claim 2 wherein the non-fluidic control valve (6) is adapted to be operated other than manually.

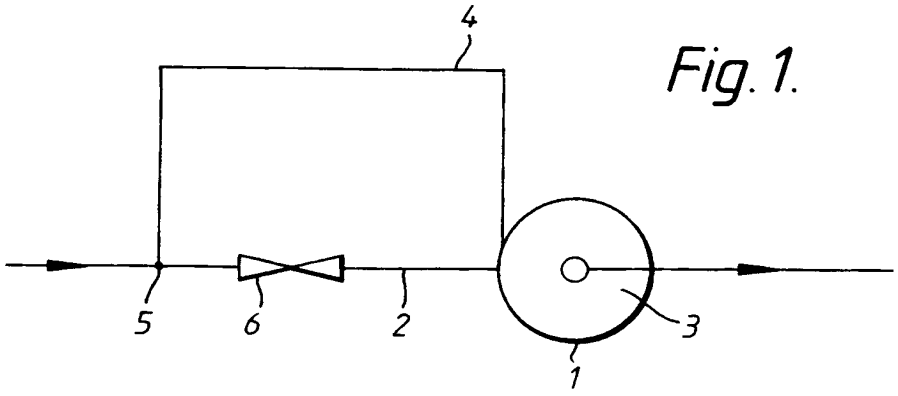


Fig. 1.

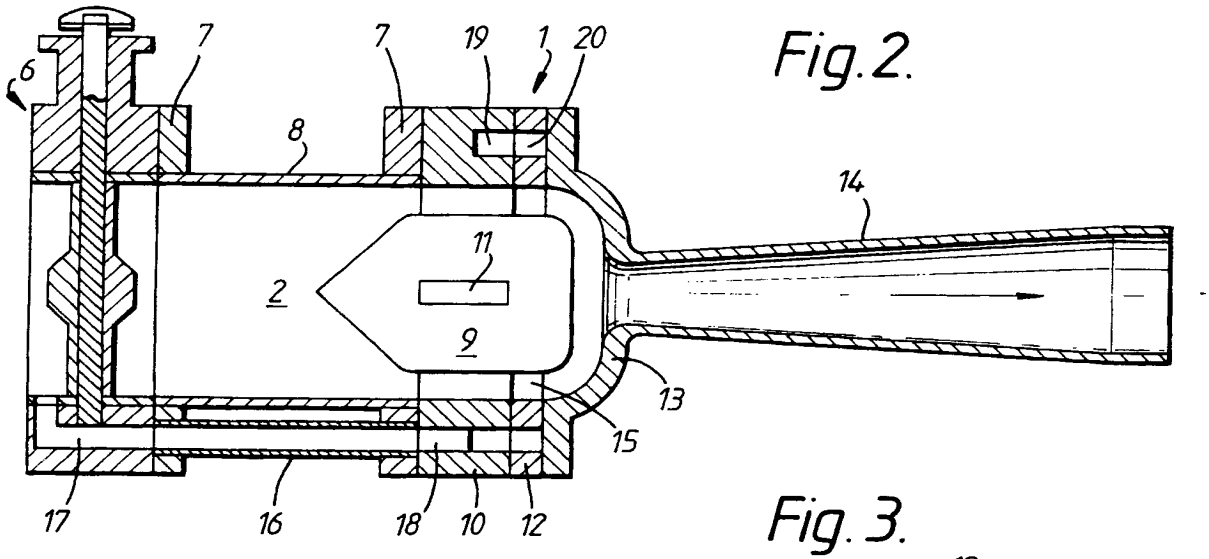
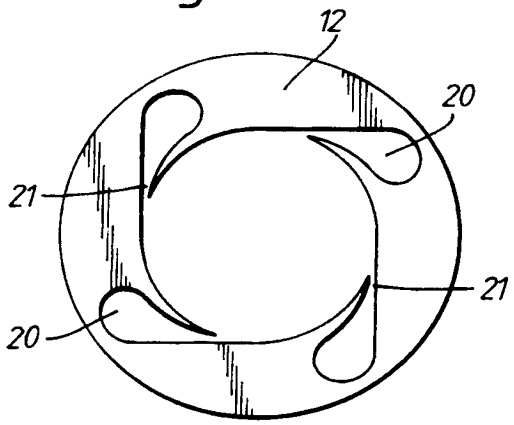


Fig. 2.

Fig. 3.



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(84) Designated Contracting States: **BE CH DE ES FR IT LI NL**

(88) Date of deferred publication of the search report: **14.04.93 Bulletin 93/15**

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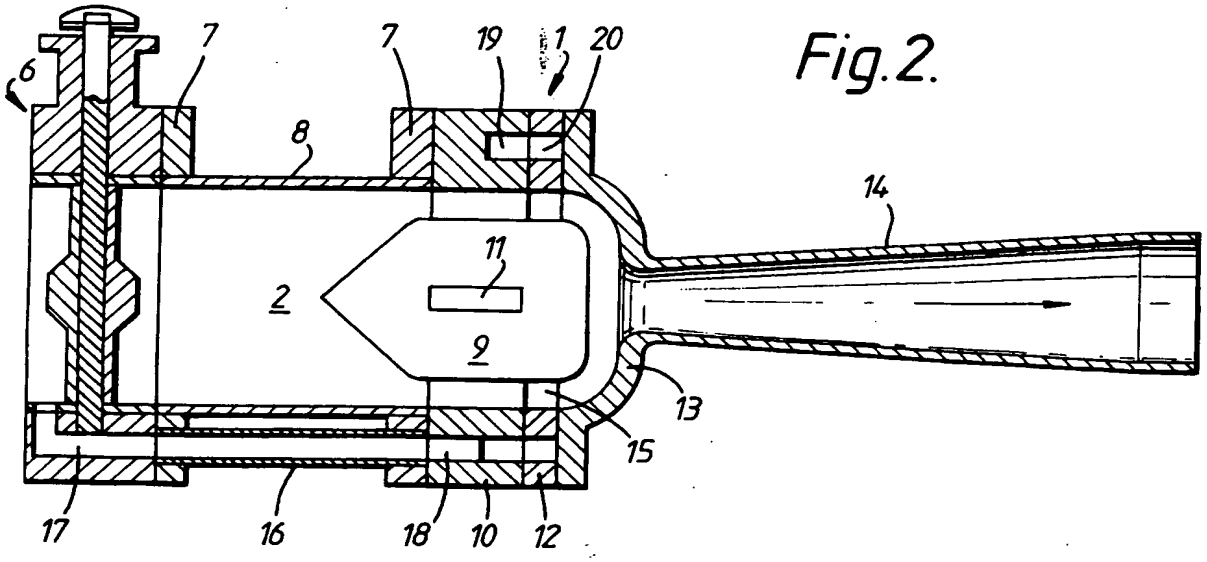

Fig.2.

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EUROPEAN SEARCH REPORT

Application Number

EP 92 30 6783

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 305 163 (UNITED KINGDOM ATOMIC ENERGY AUTHORITY) * abstract; figure 1 *	1	F16K 47/02 F16K 47/08 F16K 13/00 F16K 27/00 F15C 1/16
A	GB-A-1 376 746 (DOWTY FUEL SYSTEMS) * claim 1; figures 1,2 *	1,3	
A	US-A-3 695 290 (EVANS) * figure 4 *	2	
A	DE-B-1 955 973 (SPERRY RAND CORPORATION) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F16K
F15C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	22 JANUARY 1993	SCHLABBACH M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P0401)